searches into African myths and beliefs. I single out one point for comment. The Ibo name is given of the Spitting-cobra, that African cobra which seldom strikes at man directly with its fangs, but by a muscular compression of the poison-bag ejects the venom through the hollow tooth to a considerable distance, aiming generally at the eyes of the person it is striking. The Spitting-cobra was, I believe, first heard of in South Africa through the Dutch colonists in the eighteenth century, and it was regarded for a long time as a zoological fable. During the last twenty or thirty years, however, the fact that this cobra (*Naja haje,* or more likely *Naja nigricollis*) can and does really eject its venom with deliberate aim was attested by the present writer and by many other African explorers, and is now a proved fact. This spitting snake is credited with another accomplishment, not merely in Iboland, but in the beliefs of the natives of East Africa, of Nyasaland, of the Gaboon, the Congo basin, and the Cameroons. It is said to utter a sound like the crowing of a cock. [I have heard this allegation sometimes made in regard to the Tree-cobras, *Dendraspis.*] In Mr. Thomas's Ibo Dictionary the cock-crowing is attributed to the Spitting-cobra, as it is in some other parts of Tropical Africa. It is, at any rate, a curious coincidence that this story should be told of one or other of the cobras in Africa, independently, and without any possible collusion between the Europeans who record these statements. At the same time, I do not know that proof has been adduced that this or any other snake could utter any cry but a hiss. If, however, it is shown that the native stories are true, and that there is a snake in Africa which crows like a cock, it may be at the base of the old Greek stories of the Basilisk. H. H. JOHNSTON.

AMERICAN LECTURES ON MATHEMATICS.

American Mathematical Society. Colloquium Lectures. Vol. iv., "The Madison Colloquium, 1913." (i.) On Invariants and the Theory of Numbers. By L. E. Dickson. (ii.) Topics in the Theory of Functions of Several Complex Variables. By W. F. Osgood. Pp. iii+iii+110+iii+111–230. (New York: American Mathematical Society, 1914.)

Elementary Theory of Equations. By Prof. L. E. Dickson. Pp. v+184. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1914.) Price 7*s.* 6*d.* net.

THESE works are very different in scope, but may be noticed together as examples of the way in which mathematics is studied in the United States. Prof. Dickson's treatise on the theory of equations is suited for the average university student, and it is interesting to see how an accurate and distinguished mathematician like the author chooses and discusses his topics. He begins with graphics; and here he does what so many fail to do—gives a warning example to show the risk of drawing wrong conclusions from free and easy plotting. Graphical methods are very useful in this theory in connection with such things as Fourier's theorem, Newton's approximation rule, etc.; they are not trustworthy substitutes for calculation when the real roots of a given equation have to be found. Other things dealt with are the elementary theory of cubics and quartics, symmetric functions, separation and calculation of real roots, determinants, systems of linear equations, resultants. The proof of the fundamental theorem for symmetric functions is the proper one: namely, by establishing the one-one correspondence of the highest part of any given symmetric function to that of a definite product of coefficients—not using the theorem about the sums of powers of the roots. The proof that every equation has a root is substantially that of Gauss; this is a rather noteworthy fact. The omission of the Galois theory is quite natural; but we are inclined to regret that the author did not comment on the solutions of the cubic and quartic so as to show their common features, and prepare the way for group-theory.

The same author's lectures in the Madison Colloquium are addressed to experts, and expound what may be called in the first instance a new and amusing mathematical game. Forms and linear transformations are considered, not absolutely, but with reference to an ordinary integral modulus; the result is to change the problem of finding a complete system of covariants and invariants into one of an entirely different character. Connected with this we have a theory of "modular geometry," and in such things as group-study and the study of configurations this seems likely to be of considerable service. The theory is worked out in detail for a quadratic form in m variables to modulus 2.

Prof. Osgood's course is on the very difficult theory of analytical, and in particular algebraic, functions of two or more independent variables. So far as the subject admits, it is an admirably clear and interesting account of the principal results hitherto attained; in particular, those due to E. E. Levi. A remarkable result of recent investigations is to show that a theorem of Weierstrass's about essential singularities is incorrect. It should also be noted how, here and

© 1914 Nature Publishing Group

there, the theory of sets of points comes into the argument. Abundant references are given to original sources, and in every respect this course seems to be an admirable guide for those who feel inclined to explore this very important, though thorny and still undeveloped, field.

G. B. M.

CHEMISTRY: PURE AND APPLIED.

(1) *Geschichte der Chemie von den altesten Zeiten bis zur Gegenwart zugleich Einfuhrung in das Studium der Chemie. Vierte Auflage.* By Prof. Ernst von Meyer. Pp. xiv + 616. (Leipzig: Veit and Co., 1914.) Price 13 marks.

(2) *Chemistry and its Borderland.* By Dr. A. W. Stewart. Pp. xii + 314 + 11 plates. (London: Longmans, Green and Co., 1914.) Price 5*s.* net.

(3) *Industrial Chemistry for Engineering Students.* By Prof. H. K. Benson. Pp. xiv + 431. (New York: Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 8*s.* net.

(1) SINCE the date of the first edition in 1888, Prof. v. Meyer's History of Chemistry has been the fullest account of the progress of the science, and most of the present-day chemists owe much of their knowledge of the work of their predecessors to its perusal. In the earlier editions the work of individual chemists was given under their respective names, and it was difficult for the reader to get a clear idea of the development of chemical theory as a whole. In this respect it was inferior to the shorter histories of Wurtz and Tilden, in which the individual workers are mentioned indeed, but their work forms a continuous narrative. In the later parts of this new edition this defect has been largely removed, but without re-writing the whole book it could never be made into a history from which a student could obtain a clear idea of the way in which our present idea of chemical theory had been arrived at. Historians will undoubtedly differ in their estimate of the importance of the several branches of their subject, and probably no two chemists would agree as to the proportion of attention which should be given to any one branch. For instance, it would seem unnatural to many that only three pages out of six hundred should be devoted to Mendeléeff's periodic classification of the elements, the only great generalisation which binds together the otherwise disconnected facts of inorganic chemistry, and that the important additions which Sir J. J. Thomson (spelt Thomsen) has made to chemical science should be dismissed in two lines.

(2) It is difficult to imagine for what class of readers this book is intended. An attempt to teach the final conclusions of a complicated and difficult science in a book of 300 pages, starting *ab initio,* is foredoomed to failure. To the country clergyman who wishes to keep "abreast with the times" it may do no great harm, but it is to be hoped that it will never be given as a prize to a promising schoolboy. A statement like "Inorganic chemistry now includes the chemistry of all the compounds which do not contain any carbon," may be a slip, but the description of the discovery of argon is an untrue representation of the facts. There is a whole chapter on the transmutation of the elements in which the case for transmutation is stated at great length, while the barest mention is made of experiments on the other side. Collie and Patterson have maintained a most praiseworthy reserve as to the conclusions to be drawn from their experiments, and the author would have done well to imitate their reticence.

(3) Of the importance of a knowledge of chemistry to engineering students no one now has any doubt. All the most eminent engineers when consulted as to the curriculum of an engineering school, have emphasised the absolute necessity of the inclusion of an adequate chemical training. In spite of this at least two universities in this country ignore the subject for their engineering students, partly because the authorities consider that the course is already too extended, and partly because it is sometimes difficult to persuade the students of the importance of knowing the character and properties of the materials with which they will have to work. In the best engineering schools, however, the students have a preliminary course of pure chemistry during their first year, followed in the next year by a course of more technical chemistry as applied to engineering. This consists of three principal divisions: (1) Fuels of all descriptions and their modes of application; (2) metallurgy, including the composition and properties of alloys; (3) water in relation to boiler practice, cements and protective materials and coatings.

Prof. Benson has expanded his lectures to engineering students in the University of Washington into the book under review, and judging from it the young American engineer has a chemical training similar to that given to our own students. It is always a matter of difficulty to make a book from lecture notes, and it must be admitted that this one is not free from the defects which are seen in most other books produced in similar circumstances. Most of the descriptions of plant and apparatus are too brief to indicate the way in which the apparatus works, and in many cases a diagrammatic representation would

© 1914 Nature Publishing Group